

ASPHALT BINDER CONTENT DETERMINATION OF ASPHALT MIXTURES BY PLANT RECORDATION

1. SCOPE:
 - 1.1. This method documents the procedures for the determination of the asphalt binder content (AC) of asphalt mixtures by means of the asphalt mixing plant's recordation system. When selecting this option, determine the AC on the basis of the plant's recordation of the asphalt binder quantity.
 - 1.2. Section and subsection references herein are to the **Kentucky Transportation Cabinet's (Cabinet) Department's Standard Specifications for Road and Bridge Construction (Specifications)**.
2. SIGNIFICANCE AND USE: This method is one of a group of approved means of determining the AC of asphalt mixtures. Other means include Kentucky Method (KM) 64-405, *Extraction of Binder From Asphalt Paving Mixtures*; KM 64-437, *Asphalt Binder Content Determination of Asphalt Mixtures by the Nuclear Asphalt Content Gauge (NACG)*; KM 64-438, *Asphalt Binder Content Determination of Asphalt Mixtures Based on the Maximum Specific Gravity*; or AASHTO T 308, *Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method*. Use KM 64-436 for acceptance, process-control, or informational testing.
3. QUALITY CONTROL PLAN:
 - 3.1. When so desired, indicate on the submitted Quality Control Plan (QCP), TC 64-418 form, that plant recordation by printed ticket will be the primary means of AC determination. Further indicate the alternate, or "backup," means of AC determination if the plant recordation system should break down or malfunction.
 - 3.2. The **Cabinet** Department will consider the TC 64-418 form to be part of the plant acceptance file. The **Cabinet** Department will maintain the TC 64-418 form on file at the District Materials office. Prominently post the TC 64-418 form at the field laboratory. Document all changes in the TC 64-418 form, and submit a revised form specifying the changes for approval. If the plan is to change from project to project, include the revised TC 64-418 form as a part of each project's file.
4. APPROVAL:

- 4.1. Prior to utilization of this means of AC determination, the Cabinet Department will inspect and approve the recordation system. Produce sample tickets for review by the Cabinet Department. Ensure these tickets contain the required information listed later in this method. Demonstrate and document the tolerance compliance for all components. The Cabinet Department will include this documentation in the plant acceptance file.
- 4.2. Ensure the weights comply with the tolerances specified in Subsection 401.02.03 for batch plants.
- 4.3. For drum plants or any type of plant utilizing an asphalt flowmeter, ensure the asphalt control unit complies with the tolerances specified in Subsection 401.02.01 H).
- 4.4. For drum plants or other types of plants that utilize belt scales for production control, ensure the belt scales/weighing system complies with the tolerances specified in Subsection 401.02.05 A).
5. SCALE CERTIFICATION AND SYSTEM CALIBRATION: Conform to the requirements for scale certification and system calibration specified in the Department's *Standard Specifications for Road and Bridge Construction*.
6. RECORDATION REQUIREMENTS:
 - 6.1. Ensure an automatic digital record can be produced for each batch or specified interval, or on demand, for asphalt mixtures produced. Use the automatic printer system in conjunction with the automatic batching/proportioning and mixing control systems previously approved by the Engineer.
 - 6.2. Ensure the digital record is clearly legible and includes the following: the Contractor's identification [company name, Kentucky Materials Information Management System (KMIMS) producer code number, location, etc.], date, time, project number or code (proposal code number), and type of mixture or KMIMS code for the mixture produced.
 - 6.3. For batch plants, ensure the record further includes: the tare weight of the aggregate weigh box, tare weight of the asphalt weigh bucket, cumulative or net weights as batched for each bin including mineral fillers, liquid anti-stripping additives blended in-line, recycled-asphalt pavement (RAP), weight of asphalt, and a batch total for all net ingredients.
 - 6.4. For drum plants, ensure the record further includes: the dry aggregate weight of aggregate flow from each bin or the accumulated weight of all aggregates on the collector belt, and the asphalt flow rate. When using mineral filler, RAP, or liquid anti-stripping additives blended in-line, record the flow rate of each constituent. Include the accumulated total for aggregate, asphalt, and total mix.

- 6.5. The **Cabinet** Department may approve deviations from the previously stated recordation requirements upon inspection by the Engineer.
- 6.6. For all projects utilizing plant recordation for AC determination, supply one printed ticket for each 15-minute production interval. Supply printed tickets for each batch or lesser time intervals if the system design and programming so dictate. Analyze all printed tickets to ensure compliance with the tolerances.

7. VERIFICATION OF ACCURACY:

- 7.1. When the Contractor elects to use recordation for AC determination, the **Cabinet** Department will perform a comparison by another method [solvent extractions when performed by the Contractor and witnessed by **Cabinet** Department personnel, NACG, ignition oven, or back-calculation from the maximum specific gravity (G_{mm})] for the initial verification of accuracy.
- 7.2. The **Cabinet** Department will perform a minimum of three suitable comparisons. The average of the three comparisons shall be within ± 0.3 percent of the recorded value. Further, the three AC values shall be within ± 0.3 percent of each other.
- 7.3. The **Cabinet** Department will correct the verification values determined according to either KM 405, KM 437, KM 438, or T 308 for the moisture content [determined according to KM 64-434, *Determination of Moisture Content in Asphalt Mixtures (Rapid Field Test)*].
- 7.4. The **Cabinet** Department will investigate actual deviations outside ± 0.3 percent. In these instances, complete the necessary corrections or adjustments. Upon completion of these corrections, the **Cabinet** Department will perform additional verification testing.

NOTE 1: When deviations larger than ± 0.3 percent occur, the **Cabinet** Department will determine whether the plant production facilities are inaccurate or the ability to verify the accuracy of the asphalt supply system has been exceeded. When this condition (average of three tests deviating by more than ± 0.3 percent) occurs, the **Cabinet** Department will perform further evaluations to investigate the cause of the deviation. The **Cabinet** Department may require monitoring scale pulls, verifying scale accuracy (hanging test weights or rechecking scales), or calibrating the asphalt delivery system.

- 7.5. In addition to the above-described initial verification, validate the accuracy of the proportioning system of the plant. The Engineer will perform a minimum of one validation for each 12,000 tons of production. Validate the AC by one of the approved means of AC determination or by attaching test weights. The validation of the aggregate-proportioning system, if needed, shall consist of hanging test weights, recalibration of the

aggregate-feed rate, or other means proposed on the TC 64-418 form and approved by the Engineer. Document such validations, and include the results as part of the project acceptance record, on the appropriate *Asphalt Mixtures Acceptance Workbook* (AMAW). When validating the recordation system, ensure the test result falls within ± 0.3 percent of the recorded value. If larger deviations are found, perform adjustments or corrections until achieving a satisfactory verification.

- 7.6. Include all records or documents of testing performed to demonstrate accuracy in the plant acceptance files.

8. PRODUCTION ACCEPTANCE:

- 8.1. Select the actual ticket (or batch, as applicable) to be used for determining the AC on a random basis according to the provisions of KM 64-113, *Sampling Materials by Random Number Sampling*.
- 8.2. For AC determination, review the printed tickets at the frequency specified in Section 402.
- 8.3. Ensure the AC is within the allowable tolerances for the mixture specified.
- 8.4. If consistently occurring, investigate the cause of deviations of more than 0.5 percent from the target AC, and perform corrective actions or adjustments.

NOTE 2: The AC of the mixture, as documented by printed ticket, should vary equally between values higher and lower than the target value. If inspection of the tickets indicate that the results are skewed from a normal distribution, perform corrective action or adjustments.

- 8.5. When deviations outside the allowable tolerances occur, immediately review additional tickets to determine the extent of the problem.
- 8.6. If the problem occurs during production, immediately acquire a sample of mixture, and retain it for check-testing. Document that a check sample has been obtained on the AMAW.
- 8.7. Cease production, as specified in Section 402, if corrective actions do not indicate that material within specifications is being produced.

9. SPECIAL CONDITIONS FOR MIXTURES CONTAINING RAP:

- 9.1. When using RAP, furnish AC test results from extraction tests from three representative samples of the RAP when submitting the "Asphalt-Mixture-Design Results" form, or

“MixPack” spreadsheet, for evaluation. Review these values to determine the consistency of the RAP and establish the percentage of recycled asphalt binder contributed to the total mixture. Consider the average AC of the original three samples to be the target AC of the RAP, and use this value to calculate the percentage of total asphalt binder in the mixture.

- 9.2. Perform one extraction test for determining the AC of the RAP during the first day of production. Perform an additional extraction test for every 1000 tons of RAP used in the mixture thereafter. If any RAP extraction test result deviates more than ± 0.5 percent from the target RAP AC, perform an additional extraction test on the RAP, and average the two test results to establish a new target RAP AC.

10. CALCULATIONS AND REPORT:

- 10.1. Determine the AC of the batch or quantity of material from the printed record.
- 10.2. For batch plants, calculate the AC by taking the amount of asphalt binder used for the batch and dividing by the total batch size, as described in the following formulas:

$$\% AC Without RAP = 100 \left(\frac{W_1}{W_2} \right), or$$

$$\% AC With RAP = 100 \left(\frac{W_1 + R_1 R_2}{W_2} \right),$$

where:

W_1 = Total weight of virgin asphalt binder in the batch (lb_m);

W_2 = Total batch size (lb_m);

R_1 = Total weight of RAP in the batch (lb_m); and

R_2 = AC of the RAP (%).

- 10.3. For drum plants, record the AC as an actual percentage for the quantity of mixture produced or as a flowrate of the asphalt binder. In the case of recordation as a percentage, simply record the AC accordingly. In the case of recordation as a flow rate, calculate the AC by taking the tons per hour of asphalt binder used and dividing by the total tons per hour of the mixture produced, as described in the following formulas:

$$\% AC Without RAP = 100 \left(\frac{W_3}{W_4} \right), or$$

$$\% AC With RAP = 100 \left(\frac{W_3 + R_2 R_3}{W_4} \right),$$

where:

W_3 = Tons per hour of virgin asphalt binder;

W_4 = Total tons per hour of the mixture produced; and

R_3 = Total tons per hour of RAP.

10.4. Report the AC to the nearest 0.1 percent on the applicable AMAW.

APPROVED _____

Director
Division of Materials

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